

CLAIMS

1. A high-frequency power supply device including an oscillator to output a high-frequency signal, an amplifier  
5 to amplify the output of the oscillator for supplying a high-frequency output to a load, and a direct-current power supply to supply a direct-current power voltage to the amplifier, the high-frequency power supply device comprising:

10 a loss calculator that calculates a loss generated in the amplifier;

a first controller which, when the calculated loss by the loss calculator exceeds a loss set value determined beforehand, causes the direct-current power voltage supplied  
15 to the amplifier from the direct-current power supply to be lowered until the calculated loss becomes equal to the loss set value, the first controller further causing, when the calculated loss is no greater than the loss set value, the direct-current power voltage supplied to the amplifier from  
20 the direct-current power supply to be maintained at an appropriate direct-current voltage set value; and

a second controller to control the output of the oscillator or the amplifier so that the high-frequency output supplied to the load from the amplifier approaches a  
25 high-frequency output set value.

2. The high-frequency power supply device according to claim 1, wherein the loss set value is set to be no greater than a

permissible maximum loss generated in the amplifier when heat generated in the amplifier reaches an upper limit of a permissible range.

5    3. The high-frequency power supply device according to claim 1, wherein the loss calculator calculates loss that is generated in a semiconductor element constituting the amplifier.

10    4. The high-frequency power supply device according to claim 3, wherein the loss set value is set to be no greater than a permissible maximum loss generated in the semiconductor element constituting the amplifier when heat generated in the semiconductor element reaches an upper limit of a  
15    permissible range.

5. The high-frequency power supply device according to claim 1, wherein the first controller causes, when the calculated loss by the loss calculator exceeds a first loss set value  
20    determined beforehand, the output voltage of the direct-current power supply to be lowered within a range that does not fall below a predetermined lower limit value in order to make the calculated loss equal to the first loss set value, the first controller further causing, when the calculated  
25    loss is no greater than the first loss set value, the direct-current power voltage supplied to the amplifier from the direct-current power supply to be maintained at an appropriate direct-current voltage set value,

wherein the second controller controls, when the direct-current power voltage is greater than the lower limit value, the output of the oscillator or the amplifier so that the high-frequency output supplied to the load from the 5 amplifier approaches a high-frequency output set value, the second controller further controlling, when the direct-current power voltage is no greater than the lower limit value, the output of the oscillator or the amplifier in order to make the calculated loss equal to the first loss 10 set value or to a second loss set value which is slightly greater than the first loss set value.

6. The high-frequency power supply device according to claim 5, wherein the first loss set value and the second loss set 15 value are no greater than a permissible maximum loss generated in the amplifier when heat generated in the amplifier reaches an upper limit of a permissible range.

7. The high-frequency power supply device according to claim 20 5, wherein the loss calculator calculates loss generated in a semiconductor element constituting the amplifier.

8. The high-frequency power supply device according to claim 7, wherein the first loss set value and the second loss set 25 value are no greater than a permissible maximum loss generated in the semiconductor element constituting the amplifier when heat generated in the semiconductor element reaches an upper limit of a permissible range.

9. A high-frequency power supply device including an oscillator to output a high-frequency signal, an amplifier to amplify an output of the oscillator for supplying a high-frequency output to a load, and a direct-current power supply to supply a direct-current power voltage to the amplifier, the high-frequency power supply device comprising:

10 a junction temperature calculator that calculates junction temperature of a semiconductor amplifier element provided in the amplifier;

15 a first controller causes, when the calculated junction temperature by the junction temperature calculator exceeds a junction temperature set value determined beforehand, the direct-current power voltage supplied to the amplifier from the direct-current power supply to be lowered until the calculated junction temperature becomes equal to the junction temperature set value, the first controller further causing, when the calculated junction temperature is no greater than the junction temperature set value, the direct-  
20 current power voltage supplied to the amplifier from the direct-current power supply to be maintained at an appropriate direct-current voltage set value; and

25 a second controller which controls the output of the oscillator or the amplifier so that the high-frequency output supplied to the load from the amplifier approaches a high-frequency output set value.

10. The high-frequency power supply device according to  
claim 9, wherein the junction temperature set value is set  
to be no greater than a permissible maximum value of the  
junction temperature of the semiconductor amplifier element.

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11. The high-frequency power supply device according to  
claim 9, wherein the first controller causes, when the  
calculated junction temperature by the junction temperature  
calculator exceeds a first junction temperature set value  
10 determined beforehand, the output voltage of the direct-  
current power supply to be lowered within a range that does  
not fall below a predetermined lower limit value in order to  
make the calculated junction temperature equal to the first  
junction temperature set value, the first controller further  
15 causing, when the calculated junction temperature is no  
greater than the first junction temperature set value, the  
direct-current power voltage supplied to the amplifier from  
the direct-current power supply to be maintained at an  
appropriate direct-current voltage set value,

20 wherein the second controller controls, when the  
direct-current power voltage is greater than the lower limit  
value, the output of the oscillator or the amplifier so that  
the high-frequency output supplied to the load from the  
amplifier approaches a high-frequency output set value, the  
25 second controller further controlling, when the direct-  
current power voltage is no greater than the lower limit  
value, the output of the oscillator or the amplifier in  
order to make the calculated junction temperature equal to

the first junction temperature set value or to a second junction temperature set value which is slightly higher than the first junction temperature set value.

5 12. The high-frequency power supply device according to claim 11, wherein the first junction temperature set value and the second junction temperature set value are set to be no greater than the permissible maximum value of the junction temperature of the semiconductor amplifier element.

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13. The high-frequency power supply device according to any one of claims 1 through 12, wherein the direct-current voltage set value is set at a value that maximizes efficiency of the amplifier within a range that causes no  
15 distortion of a waveform of the high-frequency output.